

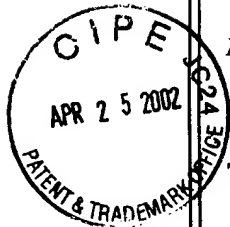
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TC 2800 MAIL ROOM



Applicant(s): Thomas P. Glenn, Steven Webster, Roy Dale Hollaway  
Assignee: Amkor Technology, Inc.  
Title: FLIP CHIP ON GLASS IMAGE SENSOR PACKAGE  
Serial No.: 09/713,848 Filed: November 15, 2000  
Examiner: Graybill, D. Group Art Unit: 2827  
Docket No.: G0030

Monterey, CA  
April 17, 2002

Assistant Commissioner for Patents  
Washington, D.C. 20231

AMENDMENT

Dear Sir:

In response to the Office Action dated January 18, 2002,  
enclosed herewith are:

1. A separate paper entitled "Clean Copy of Description Replacement Paragraph(s)" with a clean version of each replacement paragraph in the specification along with a clear instruction for entry (2 pages);
2. A separate paper entitled "Clean Copy of Replacement Claims" with a clean version of the claims (6 pages); and
3. A separate paper entitled "Version with Markings to Show Changes Made" with markings to show amendments to the claims and the specification (4 pages).

The above papers are incorporated herein by reference in their entireties as a part of this paper.

04/26/2002 NMOHAMM 00000026 09713848

01 FC:102  
02 FC:103

84.00 OP  
16.00 UP

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REMARKS

Applicants have amended the description to correct typographical errors and to properly reflect the status of the U.S. Patent Application cited therein.

Claim 2 has been cancelled without prejudice.

Accordingly, Claim 3 has been amended to depend from Claim 1.

Claims 1, 21 and 27 have been amended. Support for the amendments of Claims 1 and 27 appears in the specification at least at page 3, lines 20-30; page 6, line 18-22; page 13, line 7-13 and in FIGS. 2-3, 9-11. Support for the amendment to Claim 21 appears in the specification at least at page 3, lines 3-12; page 6, lines 3-10; page 9, lines 11-18 and in FIGS. 1-3 and 11.

New Claims 28-29 have been added. Support for Claim 28 appears in the specification at least at page 3, lines 3-12; page 6, lines 3-10; page 9, lines 11-18 and in FIGS. 1-3 and 11. Support for Claim 29 appears in the specification at least at page 6, line 23 to page 16, line 13 and in FIGS. 1-3, 9-11.

Claims 3, 11, 13, 16-19, and 25 satisfy 35 USC 112, second paragraph.

The Examiner states:

In claims 3, 16 and 25, the scope of the term "chip size" is unclear because there is no art recognized definition of the term, and the term appears to be a vague relative term of degree for which the disclosure provides no clear standard for measuring the degree, or it is not apparent if the degree is limited by the disclosure, and one of ordinary skill in the art in view of the prior art and the status of the art would not otherwise be reasonably apprised of the scope of the term. (Office Action, page 2.)

Initially, Applicants note that the term "chip size" does not appear in Claim 16. Applicants assume that the 35 USC 112, second paragraph, rejection of Claim 16-19 is in error. If the Examiner should disagree, Applicants respectfully request clarification of the basis of the rejection.

As to Claims 3 and 25, the rejection is respectfully traversed. Applicants respectfully submit that the disclosure

provides a clear standard for measuring the degree. For example, in reference to FIGS. 1 and 2, the specification sets forth:

Window 110 has an area less than an area of front surface 102F of image sensor 102. Advantageously, this allows **image sensor package 100 to be the size of image sensor 102, i.e., image sensor package 100 is chip size.** (Page 6, lines 18-22, emphasis added.)

Applicants respectfully submit that one of skill in the art would understand what is being claimed in claims 3 and 25 when read in light of the specification. Thus, Claims 3 and 25 satisfy the requirements of 35 USC 112, second paragraph.

The Examiner further states:

In claims 11 and 13 there is ambiguous and insufficient literal antecedent basis for the term "said pad." (Office Action, page 2.)

Applicants note that Claims 11 and 13 depend from Claim 10. Claim 10 recites "an electrically conductive pad" which forms the antecedent basis for the term "said pad". Accordingly, Claims 11 and 13 satisfy the requirements of 35 USC 112, second paragraph.

For at least the above reasons, Applicants respectfully request reconsideration and withdrawal of this rejection.

Claims 1, 3-15, 20-23, 26 and 27 are novel over Takase.

**A. CLAIMS 1, 3-15, 20 AND 27 ARE NOVEL OVER TAKASE.**

The Examiner asserts that Takase teaches:

2. The structure of 1 wherein **an area 7** of said window is less than an area of said first surface of said image sensor. (Office Action, page 3, emphasis added.)

Accordingly, the Examiner asserts that "an area 7 of said window", and not the total area of "the window", is less than the area of the first surface of the image sensor. Further, Takase teaches:

The optical circuit board of the present invention is basically composed by using a film-like transparent substrate 1 ... . The circuit board further comprises a plurality of metal electrodes 2 to be used for connecting with light receiving LSI **chips** 13 being disclosed on a first primary surface along the window portion 7 ... (col. 15, line 7-14, emphasis added.)

Accordingly, Takase teaches that a plurality of light receiving LSI chips 13 are mounted to the transparent substrate 1. Accordingly, the Examiner has failed to callout where Takase teaches that the total surface area of the transparent substrate 1 is less than the total surface area an individual light receiving LSI chip 13 since such an arrangement would defeat the ability to mount a plurality of light receiving LSI chips 13 to the transparent substrate 1.

For at least the above reasons, Takase does not teach or suggest a structure comprising:

an image sensor having an active area and a bond pad on a first surface of said image sensor;

a window having an interior surface and an exterior surface opposite said interior surface, **said interior surface of said window** facing said first surface of said image sensor and **having a total area less than a total area of said first surface of said image sensor**; and

an electrically conductive via extending through said window from said interior surface to said exterior surface of said window, said via being electrically connected to said bond pad,

as recited in amended Claim 1, emphasis added. Accordingly, Claim 1 is allowable over Takase. Claims 3-15, 20 and new Claim 28, which depend from Claim 1, are allowable for at least the same reasons as Claim 1. Claim 27 and new Claim 29 are allowable for reasons similar to Claim 1.

**B. CLAIMS 21-23, 26 ARE NOVEL OVER TAKASE.**

Applicants respectfully submit that Takase does not teach or suggest an image sensor package as recited in Claim 21.

Specifically, the Examiner asserts that Takase teaches:

9. The structure of 1 further comprising an electrically conductive exterior trace 3 on said exterior surface of said window, said exterior trace being electrically connected to said via. (Office action, page 4, emphasis added.)

However, in reference to FIG. 2, Takase teaches:

**A transparent protection layer 8 is provided in such a manner to cover the second primary surface including the antistatic layer 6 and the aggregated electrode 3 provided thereon.** (Col. 15, lines 46-50, emphasis added.)

Accordingly, the "exterior trace 3" is covered with a transparent protection layer 8, which would defeat the formation of interconnection structures on the "exterior trace 3". Thus, the Examiner has failed to callout where Takase teaches or suggest an electrically conductive pad on the exterior trace and an interconnection ball on the pad.

For at least the above reasons, Takase does not teach or suggest an image sensor package comprising:

- an image sensor having an active area and bond pads on a first surface of said image sensor;
- a window mounted to said image sensor, said window having an area less than an area of said first surface of said image sensor;
- a plurality of electrically conductive interior traces on an interior surface of said window;
- a plurality of electrically conductive bumps electrically and physically connecting said bond pads to said interior traces;
- a plurality of electrically conductive vias extending from said interior surface of said window to an exterior surface of said window, said vias being electrically connected to said interior traces;
- a plurality of electrically conductive exterior traces on said exterior surface of said window, said exterior traces being electrically connected to said vias;**
- a plurality of electrically conductive pads on said exterior traces; and**

a plurality of electrically conductive  
interconnection balls on said pads,

as recited in amended Claim 21, emphasis added. Accordingly, Claim 21 is allowable over Takase. Claims 22-23 and 26, which depend from Claim 21, are allowable for at least the same reasons as Claim 21.

For at least the above reasons, Applicants respectfully request reconsideration and withdrawal of this rejection.

Claims 16-19, 24 and 25 are patentable over Takase further in combination with Glenn.

As set forth above, Claims 1 and 21, from which Claims 16-19 and 24-25 depend, respectively, are allowable over Takase. Accordingly, Claims 16-19 and 24-25 are allowable over Takase.

Glenn does not cure the previously described efficiencies in Takase. Accordingly, Claims 16-19 and 24-25 are allowable over Takase further in combination with Glenn.

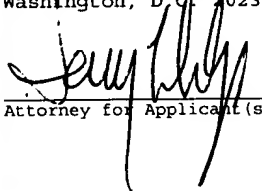
For at least the above reasons, Applicants respectfully request reconsideration and withdrawal of this rejection.

#### CONCLUSION

Claims 1, 3-29 are pending in the application. For the foregoing reasons, Applicants respectfully request allowance of all pending claims. If the Examiner has any questions relating to the above, the Examiner is respectfully requested to telephone the undersigned Attorney for Applicant(s).

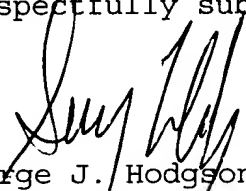
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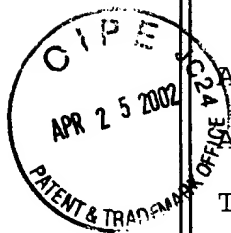
  
Attorney for Applicant(s)

April 17, 2002  
Date of Signature

Respectfully submitted,

  
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April 17, 2002

CLEAN COPY OF DESCRIPTION REPLACEMENT PARAGRAPH(S)

Replace the paragraph extending from Page 7, line 9 to  
Page 7, line 17 with:

A1  
--Package 100 further includes a window 110 above active area 104. Generally, window 110 is transparent to the radiation of interest, e.g., to the radiation to which active area 104 of image sensor 102 is responsive, as those of skill in the art will understand. Generally, the transmittance of window 110 is sufficient to allow the necessary minimum amount of radiation needed for the proper operation of image sensor 102 to pass through window 110.--

Replace the paragraph extending from Page 17, line 30 to  
Page 18, line 6 with:

A2  
--FIG. 6 is a cross-sectional view of window 110 of FIG. 5 at a later stage of fabrication. Referring now to FIG. 6, a mask 602, e.g., photoresist, is formed on metal layer 502. Mask 602 is formed to cover and protect a protected, e.g., first, region 502M of metal layer 502, which corresponds to exterior traces 116. Mask 602 also covers and protects vias 118 at the interface of exterior surface 110E, i.e., vias 118

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terminate at exterior surface 110E within protected region 502M of metal layer 502. An unprotected, e.g., second, region 502E of metal layer 502 is not covered by mask 602, and is therefore exposed and unprotected.--

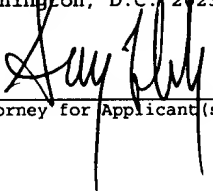
Replace the paragraph extending from Page 24, line 19 to Page 24, line 24 with:

--This application is related to Glenn et al., co-filed and commonly assigned U.S. Patent Application Serial No. 09/714,682 entitled "FLIP CHIP ON GLASS IMAGE SENSOR PACKAGE FABRICATION METHOD," which is herein incorporated by reference in its entirety.--

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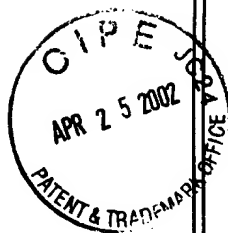
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\_\_\_\_\_  
Attorney for Applicant(s)

April 17, 2002  
\_\_\_\_\_  
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CLEAN COPY OF REPLACEMENT CLAIMS

Replace the pending set of claims in the above  
application with the following set of claims:

1. (AMENDED) A structure comprising:

an image sensor having an active area and a bond pad on a  
first surface of said image sensor;

a window having an interior surface and an exterior  
surface opposite said interior surface, said interior surface  
of said window facing said first surface of said image sensor  
and having a total area less than a total area of said first  
surface of said image sensor; and

an electrically conductive via extending through said  
window from said interior surface to said exterior surface of  
said window, said via being electrically connected to said  
bond pad.

3. (AMENDED) The structure of Claim 1 wherein said  
structure is a chip size image sensor package.

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4. The structure of Claim 1 wherein said active area is responsive to radiation, said window being transparent to said radiation.

5. The structure of Claim 1 further comprising:  
an electrically conductive interior trace on said interior surface of said window; and  
an electrically conductive bump electrically connecting said bond pad to said interior trace.

6. The structure of Claim 5 wherein said interior trace is a land aligned with said via, said bump and said bond pad.

7. The structure of Claim 5 wherein said interior trace is a metallization extending along said interior surface of said window.

8. The structure of Claim 5 wherein said via is offset from said bump, said interior trace extending along said interior surface of said window to electrically connect said via to said bump.

9. The structure of Claim 1 further comprising an electrically conductive exterior trace on said exterior surface of said window, said exterior trace being electrically connected to said via.

10. The structure of Claim 9 further comprising an electrically conductive pad on said exterior trace.

11. The structure of Claim 10 wherein said exterior trace is a land aligned with said via and said pad.

12. The structure of Claim 10 wherein said exterior trace is a metallization extending along said exterior surface of said window.

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13. The structure of Claim 10 wherein said via is offset from said pad, said exterior trace extending along said exterior surface of said window to electrically connect said via to said pad.

14. The structure of Claim 1 wherein said window includes a central region and a peripheral region, said central region being aligned with said active area, said via being formed within said peripheral region.

15. The structure of Claim 14 further comprising a bead contacting said first surface of said image sensor and further contacting said peripheral region of said window, said bead forming a seal between said peripheral region of said window and said image sensor.

16. The structure of Claim 15 wherein said window, said bead, and said image sensor define a sealed cavity.

17. The structure of Claim 16 wherein said active area is responsive to radiation, said cavity containing a medium transparent to said radiation.

18. The structure of Claim 17 wherein said medium is air.

19. The structure of Claim 17 wherein said medium is an encapsulant.

20. The structure of Claim 1 further comprising an image sensor substrate comprising said image sensor.

21. (AMENDED) An image sensor package comprising:  
an image sensor having an active area and bond pads on a first surface of said image sensor;

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a window mounted to said image sensor, said window having an area less than an area of said first surface of said image sensor;

a plurality of electrically conductive interior traces on an interior surface of said window;

a plurality of electrically conductive bumps electrically and physically connecting said bond pads to said interior traces;

a plurality of electrically conductive vias extending from said interior surface of said window to an exterior surface of said window, said vias being electrically connected to said interior traces;

a plurality of electrically conductive exterior traces on said exterior surface of said window, said exterior traces being electrically connected to said vias;

a plurality of electrically conductive pads on said exterior traces; and

a plurality of electrically conductive interconnection balls on said pads.

22. The image sensor package of Claim 21 wherein said window comprises a central region aligned with said active area and a peripheral region, said interior traces, said vias and said exterior traces being formed within said peripheral region.

23. The image sensor package of Claim 22 further comprising a bead forming a seal between said peripheral region and said image sensor.

24. The image sensor package of Claim 23 wherein said bead has sides coplanar with sides of said image sensor.

25. The image sensor package of Claim 24 wherein said image sensor package is chip size.

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last

26. The image sensor package of Claim 21 further comprising an image sensor substrate comprising said image sensor.

27. (AMENDED) An image sensor package comprising:  
an image sensor having a bond pad on a first surface of said image sensor;  
a window having an interior surface, the area of said window being less than the area of said first surface of said image sensor;  
an electrically conductive interior trace on said interior surface of said window; and  
an electrically conductive bump electrically connecting said bond pad to said interior trace.

28. (NEW) The structure of Claim 10 further comprising an electrically conductive interconnection ball on said pad.

29. (NEW) An image sensor package comprising:  
an image sensor having an active area and bond pads on a first surface of said image sensor;  
a window mounted to said image sensor, the area of said window in a plane parallel to said first surface of said image sensor being less than the area of said first surface of said image sensor in said plane;  
a plurality of electrically conductive interior traces on an interior surface of said window;  
a plurality of electrically conductive bumps electrically and physically connecting said bond pads to said interior traces;  
a plurality of electrically conductive vias extending from said interior surface of said window to an exterior surface of said window, said vias being electrically connected to said interior traces;

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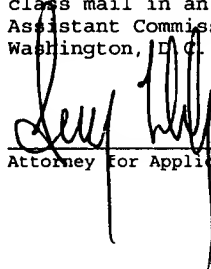
a plurality of electrically conductive exterior traces on said exterior surface of said window, said exterior traces being electrically connected to said vias;

a plurality of electrically conductive pads on said exterior traces; and

a plurality of electrically conductive interconnection balls on said pads.

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